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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication
Check-Up

PUBLISHED BY
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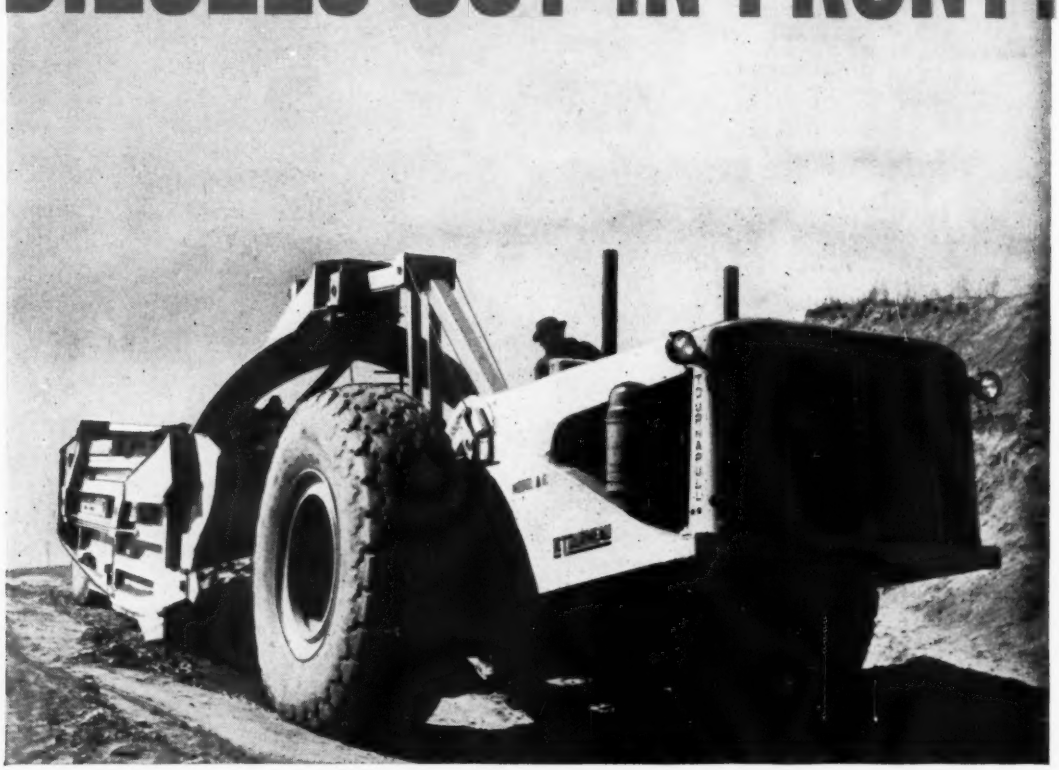

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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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Lubrication Check-Up

A CERTAIN Prince of Wales is said to have once been asked, "What do you think of civilization?" His reputed comment has a significant connection with this article: ". . . It's a fine idea. Why doesn't someone do something about it?" That applies to lubrication. It's a fine idea; why don't more plant operators do something about it? Oh, yes, they purchase excellent lubricants, perhaps they employ a lubricating engineer, they apply their lubricants by modern devices; then they expect these lubricants to function indefinitely. Sometimes a system is flushed now and then, but more often the machine is allowed to run with the addition of the usual amount of make-up oil or grease till a bearing runs hot, or the gears scuff. Then, the costs of lubrication begin to rise. For want of check-up, the machine may be lost.

THE OBJECTIVE: PROTECT THE INITIAL COST

The objective of any lubrication check-up is to: *Protect the Initial Cost.*

The automotive people observed this requirement when they furnished an instruction book with your automobile. Regardless of the rate of depreciation, the owner demands dependable operation while he runs the car. The instruction book is a guide to such operation, supplemented particularly by the lubrication schedules available at service stations; and yet, how many motorists have ever opened these instruction books, or even know where they are today?

LUBRICATION CHECK-UP AND LIFE EXPECTANCY

At periodic intervals, the motorist is advised to check the mechanical condition of his car. Experience has proved this to prolong the life of the vehicle and often the life of the driver. The wisdom of this procedure can be confirmed by vital statistics. It has been one of the contributing factors in increasing our life expectancy.

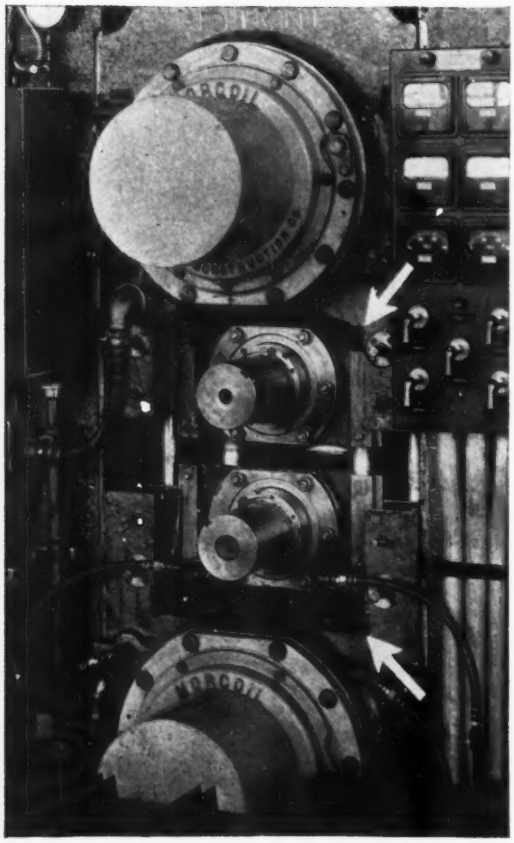
Life expectancy also applies to industrial machinery. It is measured by such terms as "wear-and-tear," "break-down," "maintenance," and "obsolescence." The latter is unavoidable. It is contingent upon the designing engineer's ability to develop more productive machinery; on the production manager's ability to run combinations of such machinery more effectually.

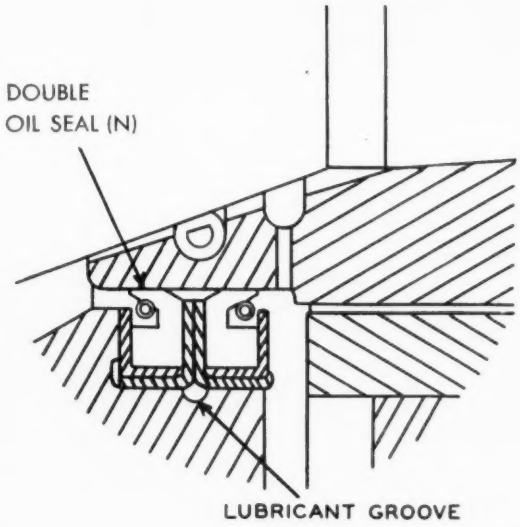
"Wear-and-tear" and "break-down," however, can be reduced materially by a planned inspection check-up procedure, primarily to see that lubrication is properly maintained and the most suitable lubricants are in use.

A lot of war-time machinery today will have to function tomorrow in the production of peace-time consumer goods. If we check up on our lubrication practices intelligently today, the maintenance headaches of tomorrow will be postponed.

LUBRICATION CHECK-UP, A FORM OF INSURANCE

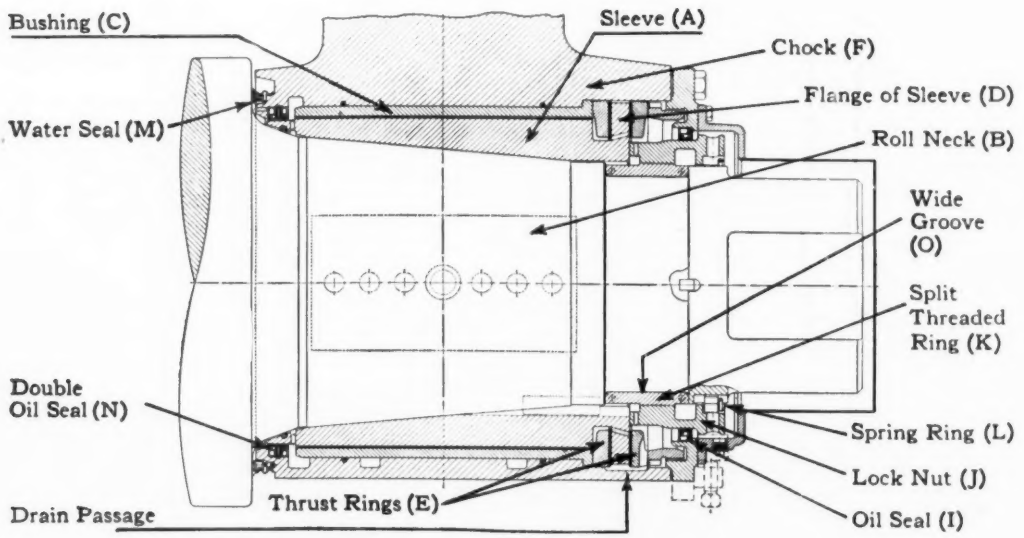
But let's go back to industry. The machine investment in the average industrial plant may easily amount to millions of dollars. To keep this machinery running requires but a few thousand dollars worth of lubricants annually. This cost can be regarded as the cost of operating insurance. It can be made doubly profitable if it is checked at regular intervals, not from the angle of actual cost, but to make sure that the lubricants and lubricating systems are doing their best. The Petroleum Industry has coined phrases for this type of check-up. Some call it an audit, others, a survey. By any name, it boils

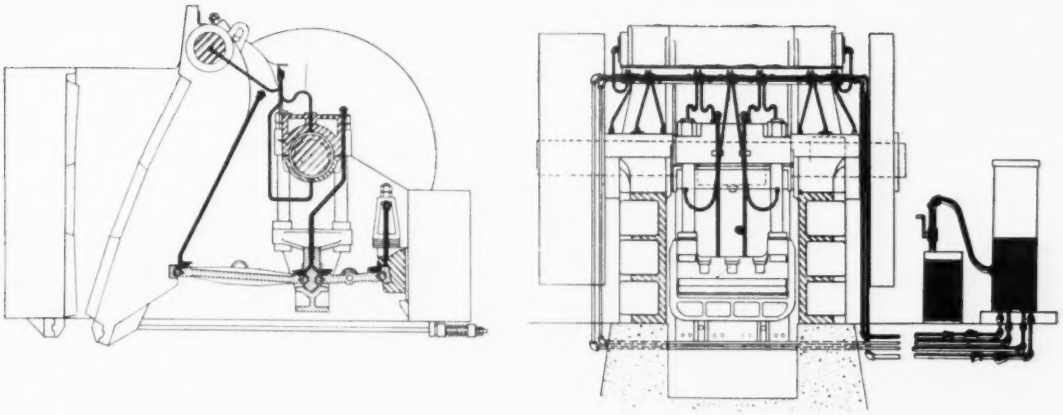




Courtesy of Morgan Construction Co.

Fig. 1—Details of the Morgoil roll neck bearing (below) with expanded view (above) showing the lubricant groove. Arrows on the photograph of the "work-side" of a 4-Hi mill point to the corners of the work roll windows, top and bottom. These arrows indicate where pressure gun fittings could be located at the end of small oil lines which could run from these points to the lubricant entrance at the other end of the chock adjacent to the end of the roll barrel where double seal (N) functions.





Courtesy of Birdsboro Steel Foundry and Machine Co.

Fig. 2–Diagram of the centralized pressure greasing system for the type "C-DF" Birdsboro Buchanan jaw crusher.

down to the same meaning – *make sure your lubricants are providing maximum protection.*

There are several angles to a lubrication check-up. For example,

a. The lubricants must be of quality commensurate with the service demanded.

b. They must be suited for the parts they are to lubricate.

c. They must be kept free from contamination.

The lubrication check-up is of particular value as a means of forestalling contamination or the entry of non-lubricating foreign matter.

When plants are running under the top-speed conditions such as prevail today, a lubricant failure due to entry of dust, dirt, or water through a worn bearing seal may disrupt the entire production schedule. At first thought, the lubricant is blamed. But that doesn't put the machine in question back on the line. Then the usual costly conference of oil company technical personnel and plant engineers is called. That costs money and time and *change of lubricant won't cure the complaint unless the cause is eliminated.*

The lubrication check-up usually will detect such a cause before it can exert its disturbing effect. It does little good to report a faulty seal, a rising neutralization number in a turbine oil, or water in a gear set if the report is merely filed. A few dollars worth of materials, a day or two of a mechanic's time often is the insignificant cost – charged to maintenance – which is all that is required to keep the machine operating day and night for months to come.

BAD ACTORS REQUIRE SPECIAL ATTENTION

In some type of service, or with any machine, some part may develop into a routine headache, just like a "trick knee" or a "weak ankle." If the lubricating engineer or plant manager enjoys (?) such a personal weakness, he watches it; doesn't run for a bus too often, or jump off moving trains. The same applies to a bearing which has the unexplainable habit of running warmer than it should. Sometimes the cause is almost impossible to find. Slight misalignment, too tight a cap-nut, scoring due to dirt particles; even lack of air circulation may be the cause.

The old-time operator nursed such parts. He gave them more oil or a pinch of sulfur to bring the temperatures down. Modern design with more attention to precision machining has reduced these "bad actors" to a large degree, but they still crop up just like a "maverick" automobile. Even so, a careful check-up will often keep them under control.

Bearing Seals

The ball and roller bearing designers have developed numerous varieties of bearing seals: *Just to keep out water and dirt and to keep the lubricant in.* The sleeve-type, oil lubricated, steel-mill bearing, in turn, is not only sealed but the seal itself should be lubricated periodically.

Is it necessary to say more about the need for proper sealing? Yet, even during a lubrication check-up, the seals may be overlooked unless the lubricating engineer remembers where to look for them and how his particular types of seals function.

A leaky ball or roller bearing seal is indicated by oil or grease leakage. Often a grease seal can be broken out by over-conscientious lubrication; in brief, too generous use of a pressure gun.

A leaky sleeve-bearing seal in steel mill service is indicated by excessive water in the oiling system. This not only overloads the oil reconditioning system, but also promotes sludge formation and corrosion.

The usual double inboard oil seal on the MORG-OIL bearing is designed to reduce contamination by preventing water or foreign matter from getting into the oiling system and keeping oil from leaking out. To do this effectively, however, the seal must be maintained in good condition and wear must be retarded as far as possible. The Morgan Construction Company provides for this by installing a lubrication fitting on the outside of the inboard end of the chock adjacent to the seal. Too often, however, this fitting is overlooked by mill operators, and the seal is allowed to run dry with the result that abnormal wear occurs. A few ounces of the same oil used to lubricate the bearings should be applied to each seal by means of a hand gun periodically. In some instances, the operators will find it advisable to run a small pipe from the lubricant entrance at the seal to the outside of the mill since a fitting on the outside of the housing on each side of the mill is in many cases much more convenient for the oiler to reach.

GOOD HOUSEKEEPING IN LUBRICATION INDICATES A GOOD FIRE RISK

Fire hazard is directly related to the fire insurance rate. A plant which is careless of lubrication soon finds out it is rated a poor risk by its fire insurance company. The inspectors check this in part by recording lubricant leakage and overheated bearings. Both may become a decided fire hazard wherever arcing or sparks may develop, especially if the materials being handled are dusty or inflammable.

Lubricant leakage may result from over-lubrication, or lack of lubrication. The former is obviously correctible by more care in application. The latter, however, if it has been caused by over-heated bearings thinning out the lubricant to excess, can be very serious. Not only is the overheated bearing a fire hazard but also it is indication that abnormal wear has probably occurred.

Here again the value of a regular lubrication check-up is evident. These conditions are less likely to occur in plants where the lubrication procedure is well-organized.

The records of the Associated Factory Mutuals Fire Insurance Companies confirm all this. Their research as to the cause of fire in textile cotton mills is particularly interesting. Table 1, based on Figure 3, shows that hot bearings have been the cause of an alarming percentage of the fires recorded.

The cause is *not the lubricant* as some have presumed; but *lack of lubrication,* with the development of hot spots due to metal-to-metal friction. A sloppy condition around any such bearing due to accumulations of leaked oil or grease invites combustion if the heat is sufficient to vaporize the more volatile hydrocarbon components. A spark is often sufficient to cause ignition if the air-gas ratio is just right.

Table 1 Data on the percentage of fires in cotton mill service attributed to friction, hot bearings and faulty lubrication. See Fig. 3.

In opener-picker service	11%	machinery 4% stock conveyors, etc. 7%
In carding service	45%	hot bearings 15% machine parts 26% others 4%
In ring spinning	31%	hot bearings 8% machine parts 17% power drives 6%
In plain weaving	61%	hot bearings 21% machine parts 37% other parts 3%
In jacquard weaving	33%	hot bearings 19% machine parts 12% pulleys 2%
Cotton tentering	30%	machine parts 9% power drives and conveyors 21%
Napping room	40%	hot bearings 30% machine parts 6% pulleys 4%

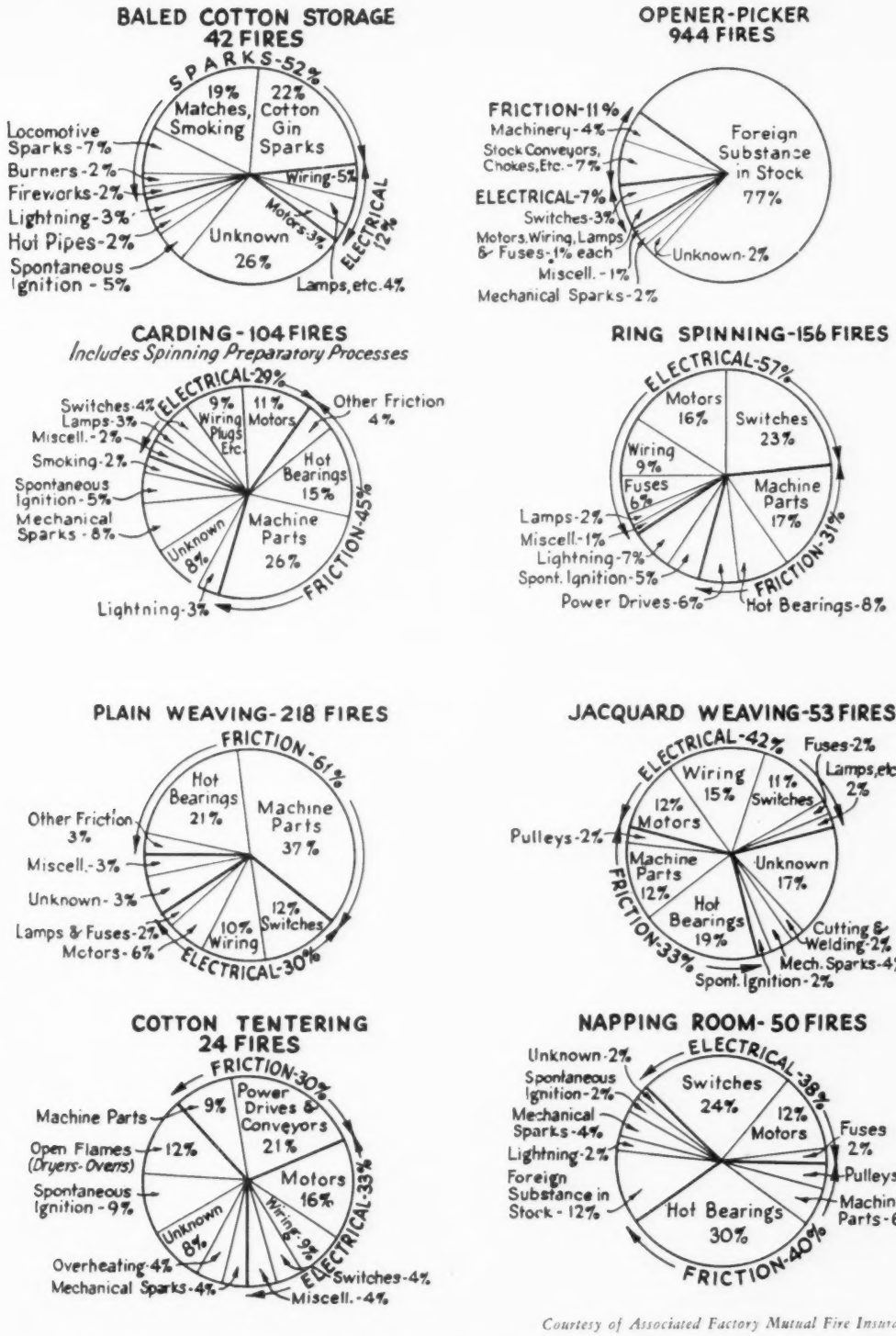
The Lubrication Engineer Is a Factor

The Lubrication Engineer can well become the guiding spirit in planning a lubrication check-up on industrial plant machinery. His experience has given him a basic knowledge of machine design, the principles of operation, the fine points of maintenance, and the limitations of his own products. Today he is a vital asset in keeping the war-time production lines in operation; tomorrow he must plan to serve peace-time industry in the post-war era.

Tomorrow he must anticipate a reborn age of machinery the operators of which will think in terms of conservation; a personnel who will have been trained to run machines on fewer grades of lubricants; yet an age of machinery in which precision design predominates.

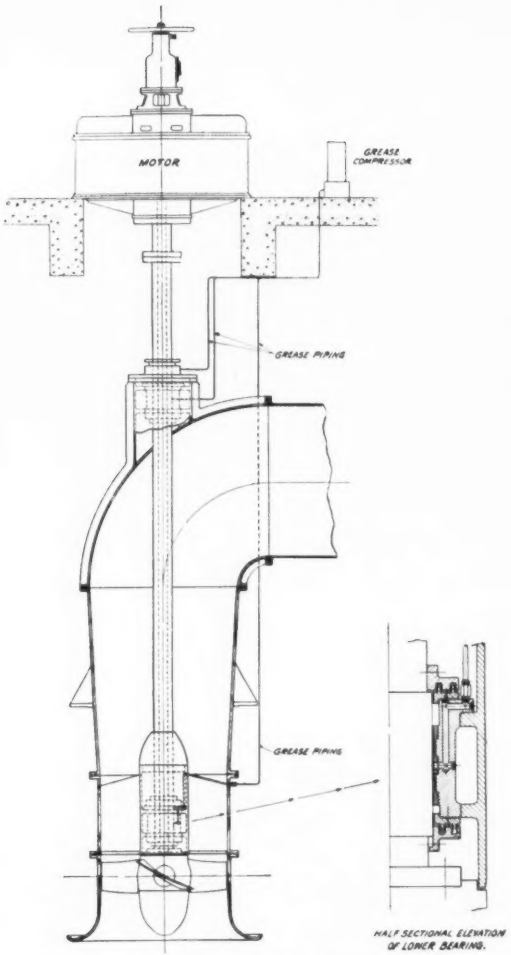
HOW THE PRINCIPLES OF MECHANICS AFFECT THE CHOICE OF LUBRICANTS

To check-up intelligently upon lubricant performance requires fundamental knowledge of the



Courtesy of Associated Factory Mutual Fire Insurance Cos.

Fig. 3—Cotton Process Fire Causes (Including No Claim Fires). Most of the fires in the manufacturing occupancies were caused by weaknesses that can be eliminated by improved machine or electrical maintenance. Careful bale-opening procedures will prevent many opener-picker fires. Fires in storage areas are caused mostly by spontaneous ignition or smoking, with some electrical, which also point out human element failures.



Courtesy of S. Morgan Smith Company

Fig. 4—Cross-sectional details of an axial flow pump showing the provisions for grease lubrication.

machinery which is being lubricated. It starts with the initial lubrication recommendation.

It is accepted practice to make a lubrication recommendation according to the operating conditions and the design and construction of the equipment involved. These factors, of course, may vary; so it is impracticable to state that for any particular type of equipment a lubricant of certain definite characteristics always should be used. Consideration should first be given to:

(a) the speed of operation,

(b) the prevailing operating temperatures,

(c) the extent to which pressure may be developed between the moving parts,

(d) the means provided for lubrication,

(e) the degree to which the wearing elements may be exposed, and

(f) the possibility of the lubricants becoming contaminated.

Certain types of machinery naturally must function with comparative satisfaction on a wide variety of lubricants. Then why all this consideration of definite lubrication recommendations?

Above and beyond the question of machine protection it is a matter of power consumption. It is perfectly true that virtually any good grade of oil or grease will develop lubrication, but how effectively this will result in the maximum reduction of friction will depend upon the ability of the resultant lubricating film to withstand the operating pressures, temperatures and speeds.

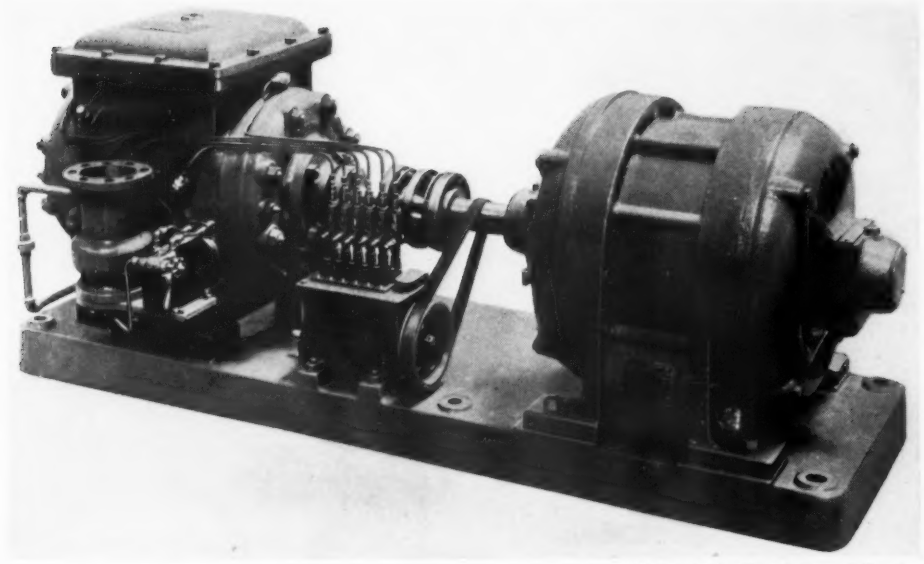
Accordingly, the lubricating engineer must study the details of design, the operating conditions, and the means of lubrication available. The relationship of lubrication to design can only be realized when he has an intimate knowledge of the intended function of the machinery with which he is dealing, and the manner in which this function has been anticipated by the designing engineer.

The intricacy of design will be determined by the function of the machine. The hydraulic turbine, for example, although comparatively massive, must be designed in a most careful manner in order that its intended alignment is maintained, and the thrust pressure developed during operation prevented from becoming so abnormal as to cause damage to the step bearings. A steam pump on the other hand is a far more simple mechanism. In consequence, it is not essential to devote any extensive amount of care to its construction, other than to insure that the moving parts fit properly. The steam pump operates normally under conditions which will not be conductive to most effective lubrication. So we do not expect the bearings of a reciprocating boiler feed pump, for instance, to show as long a life as those of a turbine.

Designing to Meet the Operating Conditions

The designing enginer considers those factors which are involved in the operation of any piece of machinery. If it is impossible to prevent a machine from coming in contact with abrasive foreign matter then he is justified in not giving it the same care as he would to a device which can be installed apart from dust or dirt, provided with means for temperature control, and guarded against water contamination.

Modern machinery is being planned with these objectives. For example, some electric motors and some varieties of machine tools are built in such a dust tight manner as to insure maintenance almost without regard for external conditions. The de-



Courtesy of Allis-Chalmers Mfg. Co.

Fig. 5—Showing the lubricator and oil piping on an Allis-Chalmers "Ro-Twin" air compressor.

velopment of the anti-friction bearing, the enclosed chain drive and the unit reduction gear set have contributed much toward better lubrication, safety and extended maintenance. But any one of these mechanisms must be lubricated initially with a lubricant which is reasonably right, and subjected to a lubrication check-up at regular intervals.

Design, in turn, can be a guide as to the degree of refinement essential in a lubricant. Where bearings, gears, chains or other moving parts are designed for comparatively rough service, it is impracticable usually to prevent drip or waste; then a cheaper grade of lubricant is justified.

Quite naturally the cheaper lubricant may not possess the same lubricating ability as a more highly refined product; on the other hand, the use of the latter under such conditions would not be economical nor assurance of any better lubrication, due to the possibility of contamination and loss of lubricating ability. Loss by unwarranted drip or waste also affects the final cost, and may develop a fire hazard. Regular check-up will enable correction in time.

Conditions which may cause waste or contamination of lubricants during operation may not always be incorrectible. There are many ways by which waste can be prevented. They will depend to a large extent (as indicated) on the design of the equipment, the product being handled, the duty involved and the location. In some steel mills, for example, especially on certain older types of equipment, gears and bearings may be inadequately housed. There is also a good deal of dirt and sometimes water around a steel plant which may come in contact with such moving parts.

Some measure of protection is gained by enclosing gears in sheet metal housings and installing bearing guards which will reduce materially the extent to which lubricants may be contaminated. In this way, the durability and life of the lubricants can be extended. Regular cleaning at the time of check-up also is helpful.

The lubricating engineer must study design from this point of view. He may, however, not always be able to prevail on the management to spend the money for such means of protection. It then becomes necessary to decide upon grades of lubricants commensurate with the operating conditions as they may prevail. A theoretical lubrication recommendation for any specific type of machine, at best, is more or less of an ideal, for it is based upon modern design and the assumption that the builders have realized the importance of lubrication and the use of suitable housings.

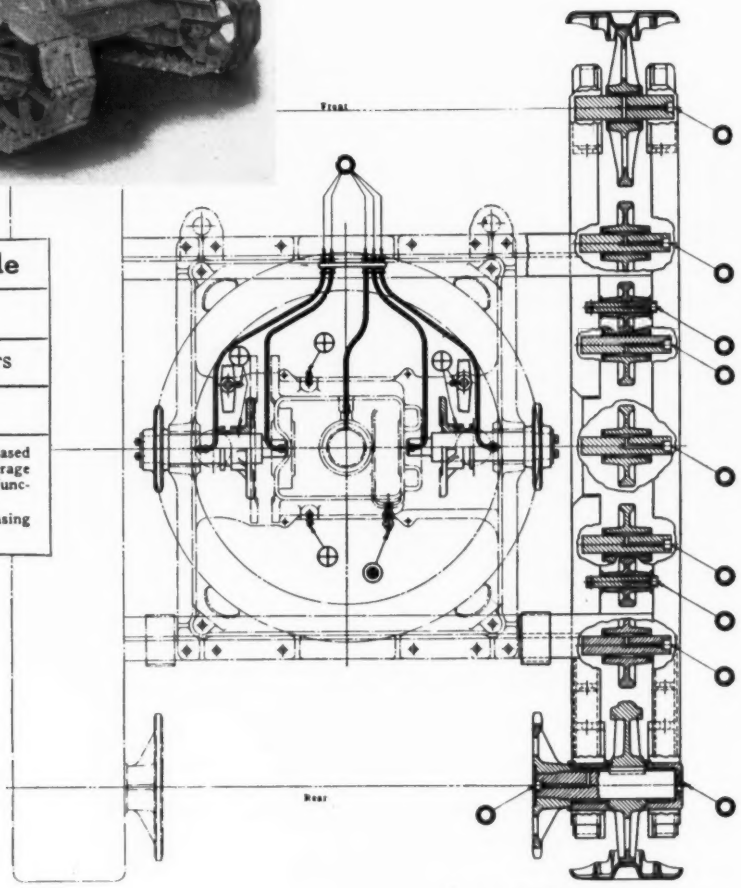
A very high grade of grease or a filtered straight mineral oil would be adaptable to such a type of design. Where an older installation is involved, the engineer should use his judgment in substituting a product which from a price point of view will be in line with the existing conditions.

A working lubrication recommendation, therefore, may at times include two or more grades of lubricants of varying degrees of refinement. Where oils are involved, they should be of around the same viscosity, commensurate with the speed, operating pressure, and the extent to which temperature variation may occur.

These are important details to the operator when

Greasing Table	
◉	OIL AS REQUIRED
⊕	ONCE EVERY 5 SHIFTS
○	ONCE A SHIFT

Above frequency of greasing is based on the travelling required in average work, where moving is a minor function.
Under other conditions alter greasing proportionately



Courtesy of Bucyrus-Erie Company

Fig. 6—Greasing table for the truck, frame, and propelling machinery on a typical Bucyrus-Erie heavy duty power shovel.

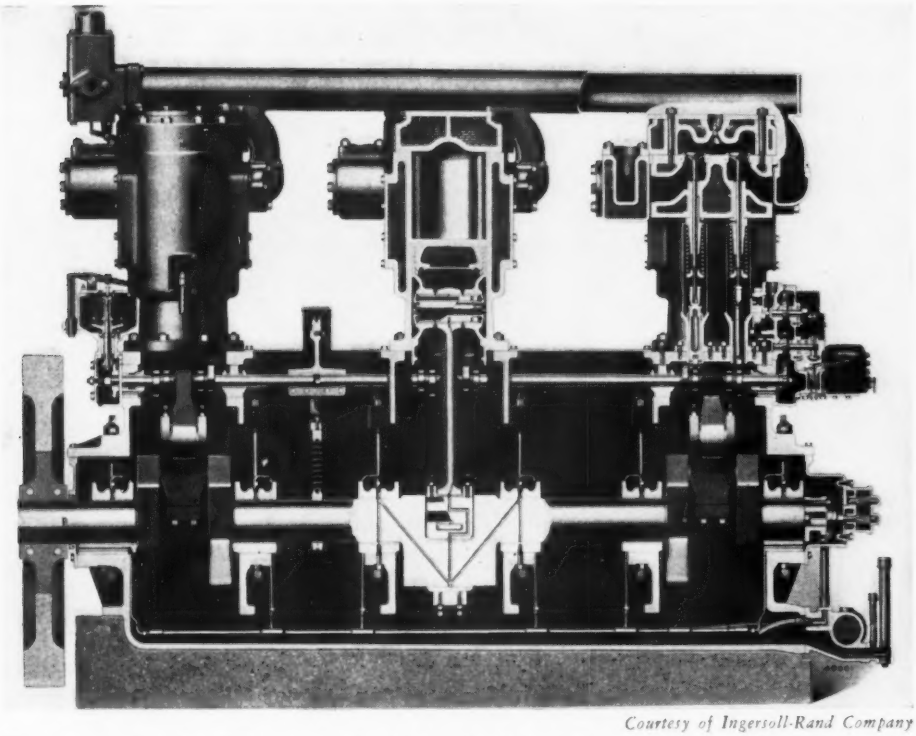
he is in the market for lubricants. If he is dealing with a representative of a reputable oil company these facts will be brought to his attention, the proper viscosity or body of the lubricant decided upon, the choice between a primary or secondary grade of lubricant justified according to the operating conditions around his plant. Periodic check-up on the performance of any such lubricant will insure the correction of conditions which might affect its dependability.

WHY OPERATING CONDITIONS SHOULD BE STUDIED

It has been noted that operating conditions include speed, pressure, temperature, the possibility of water coming in contact with wearing parts, and the chance of lubricants being contaminated with foreign matter. Speed and pressure must be regarded as inter-related especially in the choice of body of an oil or the consistency of a grease. Operating conditions influenced the initial lubrication as already stated. They also influenced the nature and frequency of the lubrication check-up.

The Effect of Speed

One of the first axioms to be developed in the study of lubrication involved the relation of speed to viscosity, i.e., that the viscosity should vary inversely with the speed. This means that for high speed conditions a comparatively light bodied lubricant can be used. Lower speeds will require a heavier product. The reason for this is that the



Courtesy of Ingersoll-Rand Company

Fig. 7—Cross-section of an XVG compressor showing how the oil circulating system for the working parts is planned to prevent leakage or contamination.

higher the speed the greater will be the degree to which the lubricant will be drawn into the clearance spaces by capillary action.

The development of a constant film of lubricant within the bearing clearance space, however, will of course be contingent upon any provisions for automatic lubrication. If oil is delivered by means of a drip feed oiler, wherein the principle is to supply just enough oil to maintain lubrication, increase in speed, unless the rate of drip of oil is increased, may result in impaired lubrication. Periodic check-up enables recording and control of the rate of oil flow.

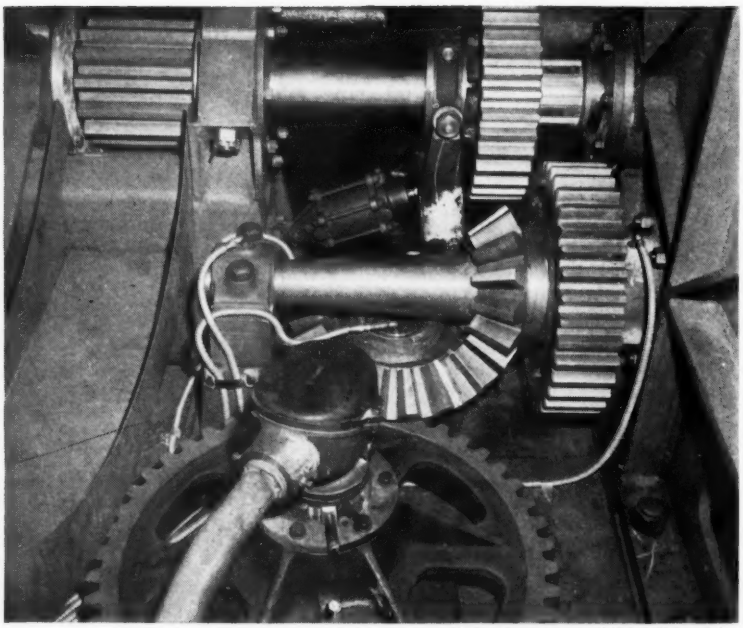
Where automatic force-feed or splash lubrication is involved, however, there usually will be more oil delivered than is required to maintain lubrication. Flood lubrication will aid in resisting the effects of pressure. This is well illustrated by the lubricating system of the average pressure—oiled steam turbine bearing. Here, although comparatively high speeds are involved, with bearing pressures of considerable intensity, if the oil is delivered at from eight to fifteen pounds pressure a product of as low a viscosity as 140 seconds Saybolt at 100 degrees Fahr., will maintain adequate lubrication and insure protection of the bearings.

Flood lubrication also is beneficial in that the excess oil passing through the bearings can remove a certain amount of the heat developed during operation, or received from any external source.

Speed leads generally to the development of a more positive lubricating film, due to the increased capillary action, or the extent to which the oil is drawn into the bearing. Speed also facilitates the use of a lighter product, which will reduce the amount of power consumed as well as the amount of internal friction developed within the lubricant itself.

Grease lubrication under high speed conditions normally involves unit mechanisms such as anti-friction bearings. Provided that the bearing is properly designed to retain grease and a product is chosen with due regard for its suitability and lubricating properties, dependable lubrication for extensive periods of operation is assured. Here the lubrication check-up is of value in preventing a careless operator from over-lubricating the bearing and perhaps ruining the seal.

The amount of grease charged to a bearing, therefore is an important factor. The bearing never should be completely filled with lubricant, for (in addition to the effect on the seal) this may not only lead to channelling of some greases, but also to over-heating, and to increased power consumption, due to the drag imposed upon the rolling elements.



Courtesy of Harnischfeger Corporation

Fig. 8—Connections from the point of centralized lubrication to the travel or propel gear drive on a P&H, Model 1500, 4 cubic yard electric excavator.

Centrifugal force becomes a factor wherever gears, chains or other motions are involved. The faster the motion the greater this force. It can have a definite effect upon lubricant throw-off from the moving parts. Here, the relationship between speed and the adhesive characteristics of the lubricants is important. This will be especially true on exposed gears or chains. In an oil-tight gear or chain housing a comparatively fluid oil can be used, especially if the oil is automatically delivered to the parts and not merely carried around by dipping of the gear teeth or chain sprockets in the bath of lubricant.

Where gears and chains are not tightly housed, thought must be given to the adhesive characteristics as well as the viscosity of the lubricant. Straight mineral petroleum products are more adaptable to these installations than compounds such as greases. Certain of these latter, of course, have comparatively high adhesive tendencies. On the other hand, they will be more expensive and not as durable for the service involved as the straight mineral gear lubricants. Here the lubricating engineer can be helpful at the check-up period by studying the installation and making his recommendation accordingly; explaining to the operator, of course, his reasons for determining the nature of the lubricant he considers advisable.

Effect of Pressure

The lubricating engineer knows that pressure is related to lubrication in that if the body or consistency of the lubricant is too low to withstand any squeezing out action which may be developed in service, considerable damage will probably follow because of lack of sufficient lubrication. It is not the fault of the lubricant.

Under average conditions the greater the operating pressure between any two moving parts, the heavier or more viscous must be the lubricating film in order to prevent metal-to-metal contact. This holds true whether bearings, gear teeth or chain link connections are involved. Pressure tends to cause squeezing out of the lubricating film from between the contact surfaces. With certain types of sleeve bearings this problem can be solved by adequate bearing area, and proper grooving. A lubrication check-up by a trained lubricating engineer will catch an unsatisfactory condition and enable correction, before it becomes serious.

The chance of impaired lubrication due to pressure also can be partially prevented by enclosed construction, and operating the parts in a bath or flood of lubricant. Sometimes pressure can be met with pressure, the lubricant being maintained within the clearance spaces in a closed system under the prevailing pressure of some form of pumping device.

Regardless of the means of application, however, a certain degree of adhesiveness and sufficient viscosity must be inherent characteristics of the lubricant itself. To make any other than generalized statements as to the viscosity range would be unwise. Too much will depend upon conditions of construction, operation and means of application. These conditions must be studied in order that the severity of the duty may be realized.

Automatic Lubrication Is Beneficial

Automatic lubrication is convenient, saves labor and requires less attention. It has been well adapted to steel rolling mill equipment, the metal press, the cement kiln, the news press and the milling machine, etc.

On any piece of machinery where pressure may prevail, remember, it is the *operating pressure* which must be considered.

When the rolling mill or metal press, for example, is idling, the pressure which may exist between the teeth of its gear trains, or upon the bearings of certain of its shafting may not be abnormal. When idling there should, therefore, be no problem in the maintenance of lubrication on such equipment.

In operation, however, the pressure to be exerted upon the raw materials to form the finished or semi-finished products will react back through practically all the moving parts of the machine. Not with the same intensity in every case, to be sure, for this will depend upon the size or relative importance of the parts involved. In general, such reactionary or back pressures will be considerably in excess of the idling pressures; hence they may cause failure of a lubricating film. Then we come back to the conditions discussed under "Fire Hazard".

We are chiefly concerned, therefore, with the *operating pressure* when selecting lubricants for heavy duty machinery. The purpose, of course, must be to use lubricants which will be of such body and adhesive ability as to effectively withstand being squeezed out from between gear teeth, chain link connections, or bearings and shafting under the maximum pressure involved.

When certain machinery is idling this may result in abnormal internal friction within some lubricants, but it is better to prevent metal-to-metal contact under the maximum operating pressures and prevent the development of abnormal wear, than to reduce power consumption during idling.

Temperature and Viscosity

The effect of temperature upon a lubrication recommendation will depend upon the extent to which it may vary during operation. This becomes a factor when deciding upon the manner of preparation of a grease, its consistency or its melting point; or the viscosity of an oil.

High temperatures usually impose a greater duty upon a lubricant than any other operating condition. In this connection the possibility of metal-to-metal contact or solid friction will always be present. Solid friction between any two surfaces in motion with respect to one another implies the presence of heat, which is invariably developed by excessive friction. The lubricant must eliminate solid or metallic friction in favor of fluid friction which will normally be of far less intensity, then the potential fire hazard will be reduced.

In the presence of high operating temperatures the viscosity or body of a lubricant must be most carefully considered since viscosity varies inversely with temperature. In other words, the higher the operating temperature the lower will be the body or viscosity of the lubricant. If the original viscosity is not sufficiently high to allow for this reduction, fluidity may be increased sufficiently to cause impairment of the lubricating film to such an extent as to actually cause metal-to-metal contact.

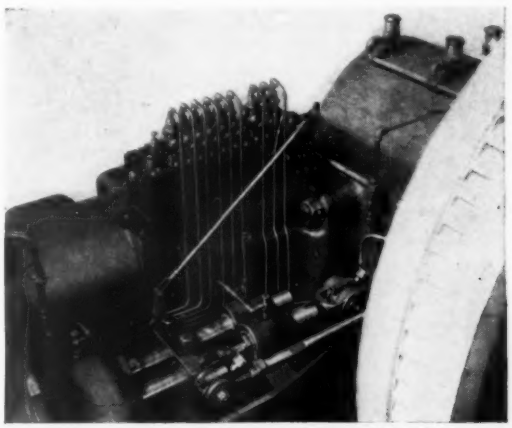
Multi-Purpose Service

Under certain conditions the fact that viscosity varies inversely with the temperature is an asset, for it may permit of one lubricant serving a number of points of varying external temperatures, provided the size of the moving parts and the pressure exerted are taken into account when the lubricant is originally selected.

On the other hand, the mistake should never be made of regarding the viscosity at say 100 degrees Fahr., as of sole importance, for an oil which might be of adequate viscosity at that temperature might be too light to meet an operating temperature range at say 150 degrees Fahr.

Under Low Temperature Conditions

It is quite as important to study the operating viscosity of an oil where low temperatures are involved as when high temperatures prevail. In low temperature operation, however, there will be less possibility of metal-to-metal contact between the moving parts. Here one is more concerned with the possibility of abnormal internal friction developing within the body of the lubricating film itself. This would involve increased power consumption. Under extreme conditions it might even render the machine inoperative. There would also be the difficulty of delivering such a sluggish lubricant to the moving parts on starting. This would mean starved lubrication and perhaps metal-to-metal contact until the temperature of the machine is raised sufficiently to expedite ready flow of the lubricant.



Courtesy of Ingersoll-Rand Company

Fig. 9—Showing how a mechanical force feed lubricator and oil piping can be applied to compressor service.

Lubricant Contamination Must Be Prevented

Any lubricant which has become contaminated with non-lubricating materials cannot function dependably however carefully the recommendations may have been made. In some industries contamination will be more prevalent than in others. It depends upon the manner of storage, the conditions under which the machinery may have to operate and the nature of the materials being handled.

In heavy industry there will be certain types of operation where a decided load will be imposed upon lubricants in general. Elsewhere comparatively high temperatures will prevail in connection with much of the equipment, as for example, in the steel rolling mill, or on cement mill kiln trunnion bearings. In the yard, crane bearings, gearing and wire rope will be exposed to the weather, dust, dirt, flying scale and water. Lubricants must be protected under such conditions so that they can function dependably.

The chance of contamination in storage will depend upon the location of the oil house or oil room and the nature of its construction. If it is near a yard hoist, or in a corner of the power plant building, where doors or windows must be left open, or when they are poorly screened, air drafts may often cause circulation of considerable abrasive dust or dirt. Then it is only necessary to leave oil or grease in open containers for a short time before they absorb whatever dust may settle on the surfaces. As most types of dust are abrasive, lubricants which have been contaminated in this way will usually tend to promote wear by virtue of their dust content instead of promoting its reduction by reason of their lubricating ability.

This can be prevented by storing lubricants in enclosed tanks or drums, with tightly fitting covers on all containers which have removable heads. Where oils are consumed in sufficient volume to warrant bulk storage, large permanent tanks often are provided into which the contents of shipping drums can be emptied, or which can be filled directly from tank cars or trucks. This enables sealing to prevent leakage of oil or entry of air. Measuring pumps, return drains, gauge connections and suitable covered hatches for filling or inspection are the usual accessory equipment in such installations.

It is easier to keep fluid oils free from contamination during storage than greases, or gear or wire rope lubricants. These latter are often so inert, and used in such comparatively small quantities, that they are stored in the shipping drums or barrels. Wherever the top is replaceable it can be readily removed when a supply of lubricant is needed, and just as easily replaced. This should prevent undue dirt or water contamination. It is true that certain greases, according to their nature, and the purpose for which they are intended, will contain more or less water; as a general rule, however, this is an accurately determined quantity. Should any more water gain entry, there might be possibility of change in the physical and chemical nature of some greases.

On the production line protection of lubricants against contamination must be observed by the personnel involved with their application. Very often, where gears may run exposed, or only partly enclosed, it will seem to be fruitless to insist on undue care in application of lubricants. In many industries the average gear is usually comparatively massive and built for rugged service. Its teeth, however, can be protected by proper lubrication, and the less contaminated the lubricant, or the more dust-proof the casing, the more effectively will wear be reduced.

Bearing wear will oftentimes be more serious than wear on gear teeth. Furthermore, scoring or wear in a bearing will usually develop more rapidly for it will normally not require as much abrasive matter in the lubricating film to damage a bearing as a gear tooth. Consequently bearings usually are constructed so as to more readily prevent entry of dust, dirt or scale. With sleeve bearings of the grease lubricated type, the collar of grease at the exposed ends will often serve as a very good seal. How much abrasive foreign matter may gain entry will largely depend upon the condition of the lubricant and how it is applied.

CONCLUSION

It is with pardonable pride that reference is made to the Petroleum Industry and the lubricating engineer in this article; but so often the latter is the key-man in promoting lubrication check-up. He can never start from scratch, with drafting board, tools, jigs and fixtures to produce his part of the assembly. His industry has to be guided by the machine designer, by reports from the field, by the dictates of the metallurgist. The latter produced the modern alloy bearing; the automotive industry proved its worth; the assembly line made it a part of the engine of today — then demanded lubrication. The Petroleum Industry, knowing all this was in progress, had the most modern engines for testing, renovated its research laboratories all over the country, changed its refinery procedures. New crude oils were evaluated, greater yield was obtained. Lubricants were produced to do the job. It is only necessary to check up periodically on their usage, the cleanliness of the lubricating systems, the maintenance of the means of application.

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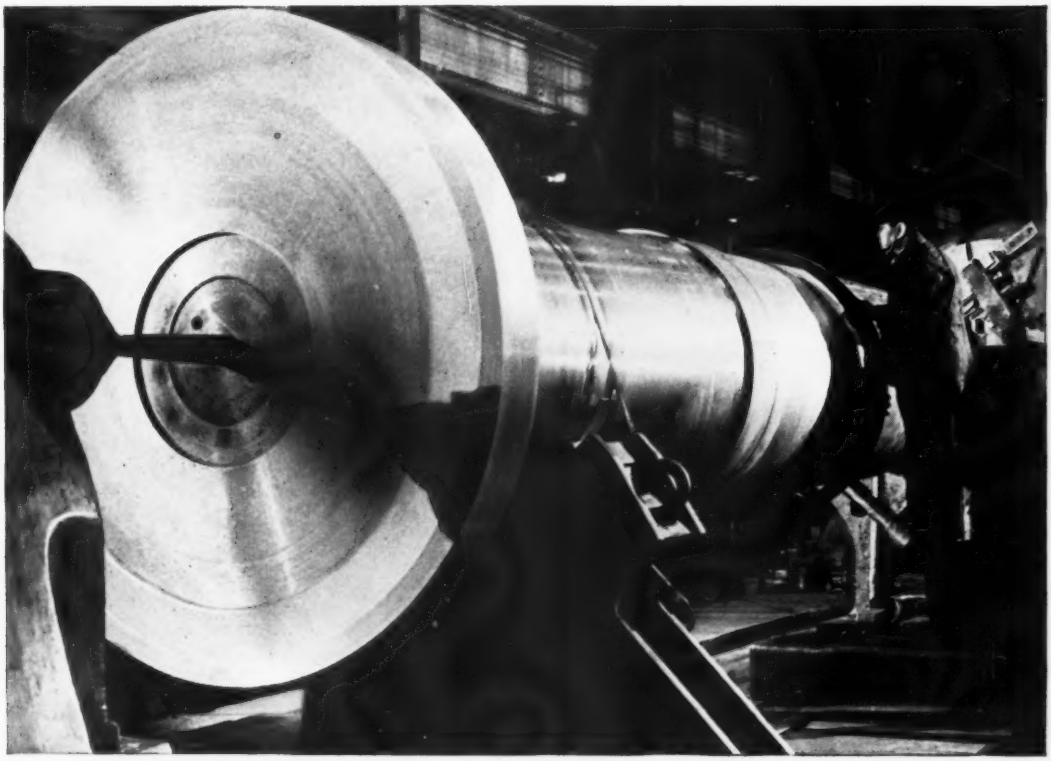

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